



The Challenge



Executive Summary:

PROBLEM: The nation's 21st century transportation demand cannot be satisfied by the planned investments in hub-and-spoke and highway systems*.

SOLUTION: The Small Aircraft Transportation System (SATS) concept can satisfy a large portion of the demand, relieving the pressure on existing ground and air systems.

SATS Planning Conference: Establish the research priorities and partnership requirements to develop and deploy SATS infrastructure and vehicle technologies.

* “. . . analysis of 15 years of data in 70 metro areas adds to the growing body of evidence that. . . highway construction is an ineffective means of managing congestion. In fact, numerous studies indicate that highway construction often generates more traffic, raising congestion levels. Given the enormous cost of highway construction, our transportation officials need to investigate a broader menu of congestion relief measures that include other transportation modes, new technology, pricing, land use, and other strategies. (Surface Transportation Policy Project: An Analysis of the Relationship Between Highway Expansion and Congestion in Metropolitan Areas -- Lessons from the 15-Year Texas Transportation Institute Study, November, 1998.)”

Similar conclusions apply to the hub and spoke system. Both hub-spoke and highway systems' abilities to accommodate more demand are constrained by their maturity phase constraints in their respective innovation life cycles.

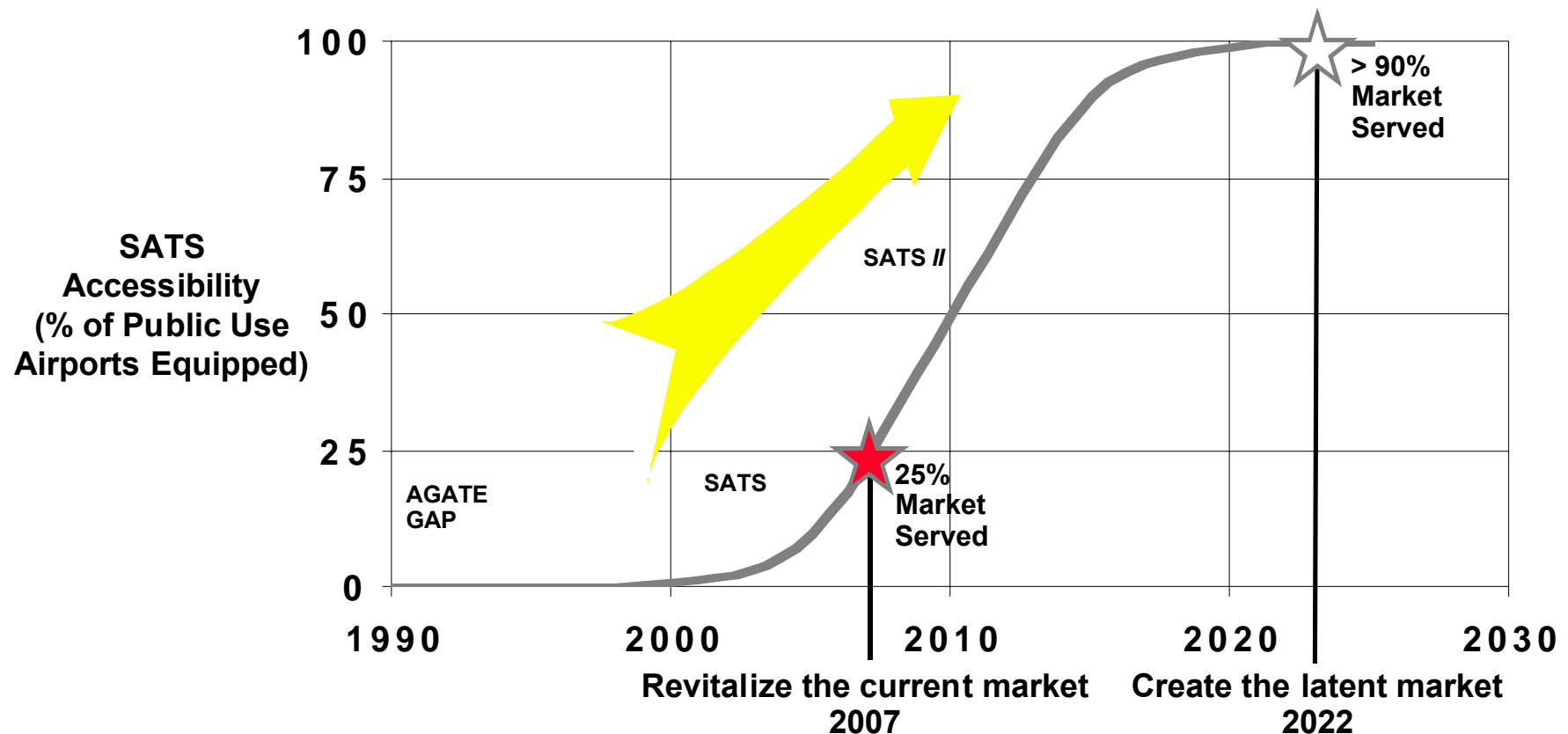
Outline



- **National General Aviation Roadmap Goal**
- **SATS Program Description**
- **Technical Approach/Objectives**
- **Candidate Federal-States SATS Partnership Roles**
- **GA Roadmap Milestones FY 2000 - 2004**
- **SATS Planning Assumptions**
- **Schedule**
- **Summary**

National General Aviation Roadmap Goal

"Enable doorstep-to-destination travel at 4 times the speed of highways to 25% of the Nation's suburban, rural, and remote communities in 10 years and more than 90% in 25 years."



Strategic Planning Tenets

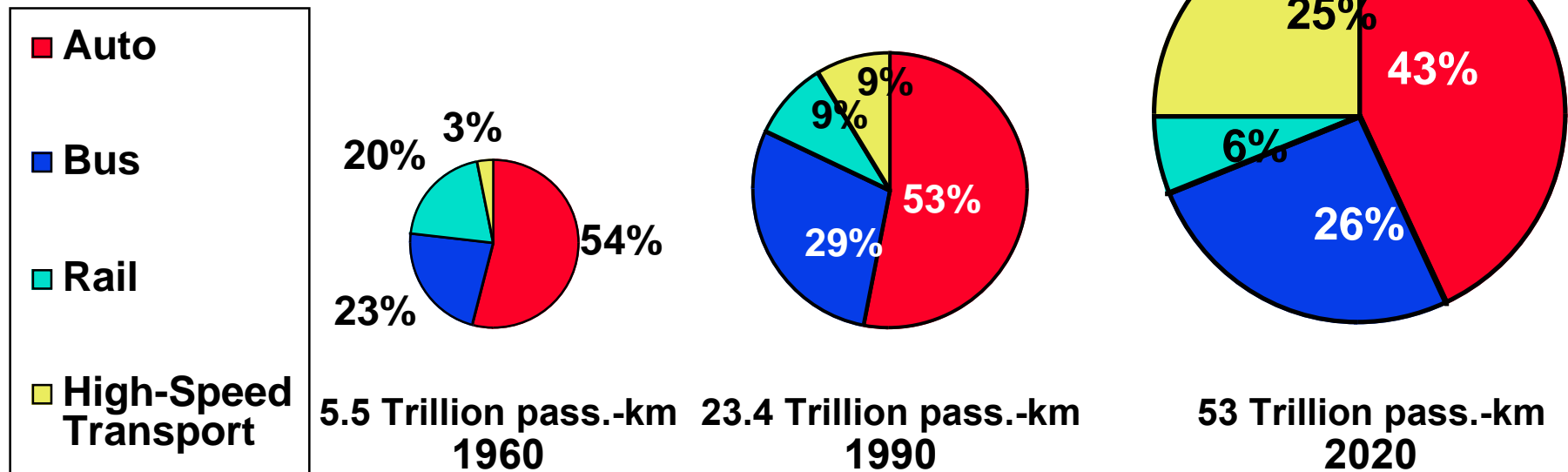
- The innate human desire for personal command of time and space creates demand for distributed (personal vs. mass) transportation systems.
- The Information Age will usher in a new magnitude for the value of time.
- The Baby Boom generation's peak spending (and traveling) period will coincide with the maturity phases of both the hub-spoke airway and interstate highway systems.
- The Third Migration Wave (from suburbs to rural America), coupled with tele-commuting, creates new transportation demand patterns.
- The revolution in digital bandwidth redistributes intelligence from centralized to distributed system nodes, establishing the basis for the aviation transition from centralized air traffic control to air traffic management (free flight).

The Pig in the Python



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**As per capita income rises,
per capita annual travel rises,
personal daily travel time budgets remain constant,
and
high-speed modes gain market share
(Schafer and Victor, *Sci. Amer.*, Oct. 1997)**

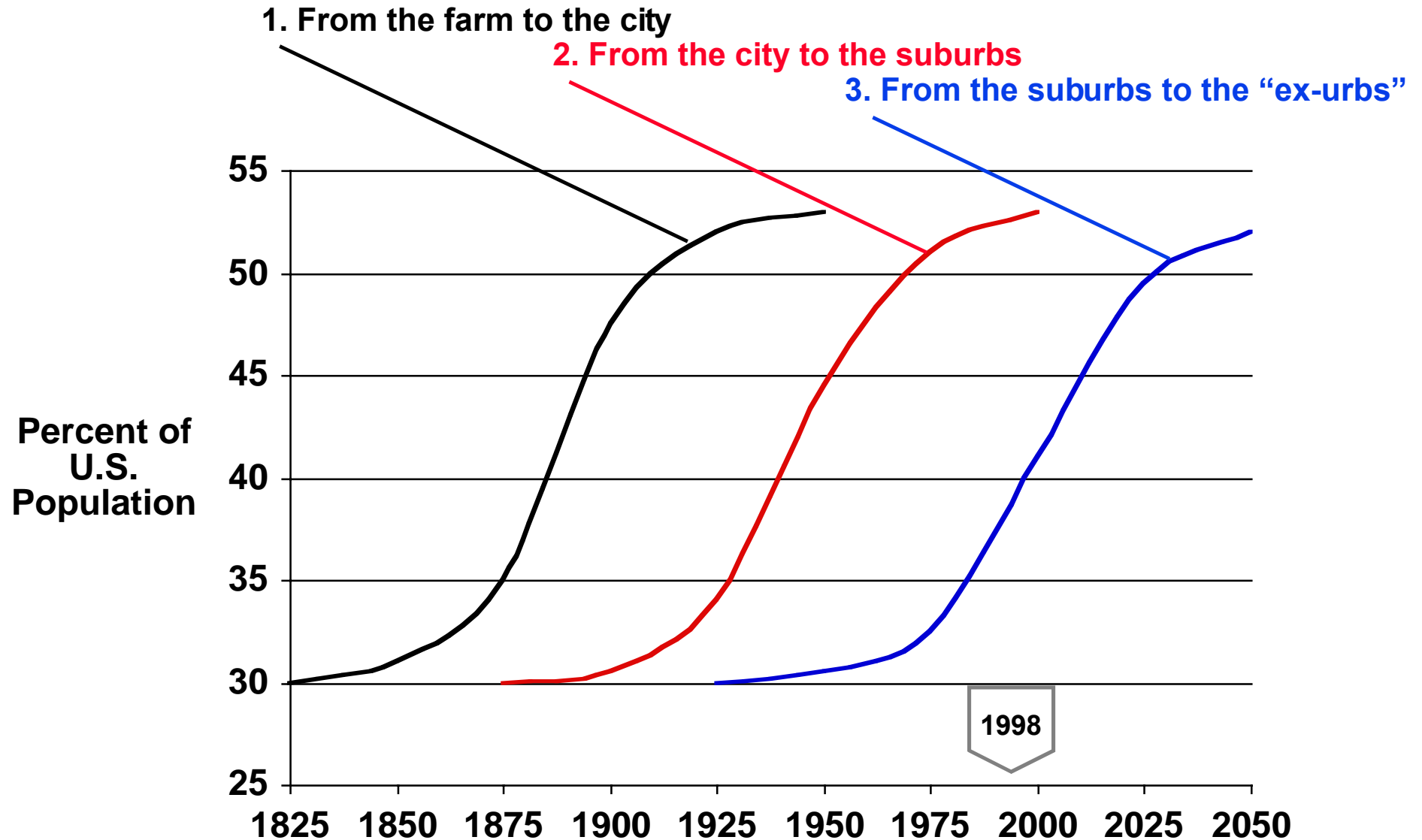


**Global Travel Mode Shares will be driven by
the largest population and spending wave in history:
The Baby Boom**

The Third Migration Wave



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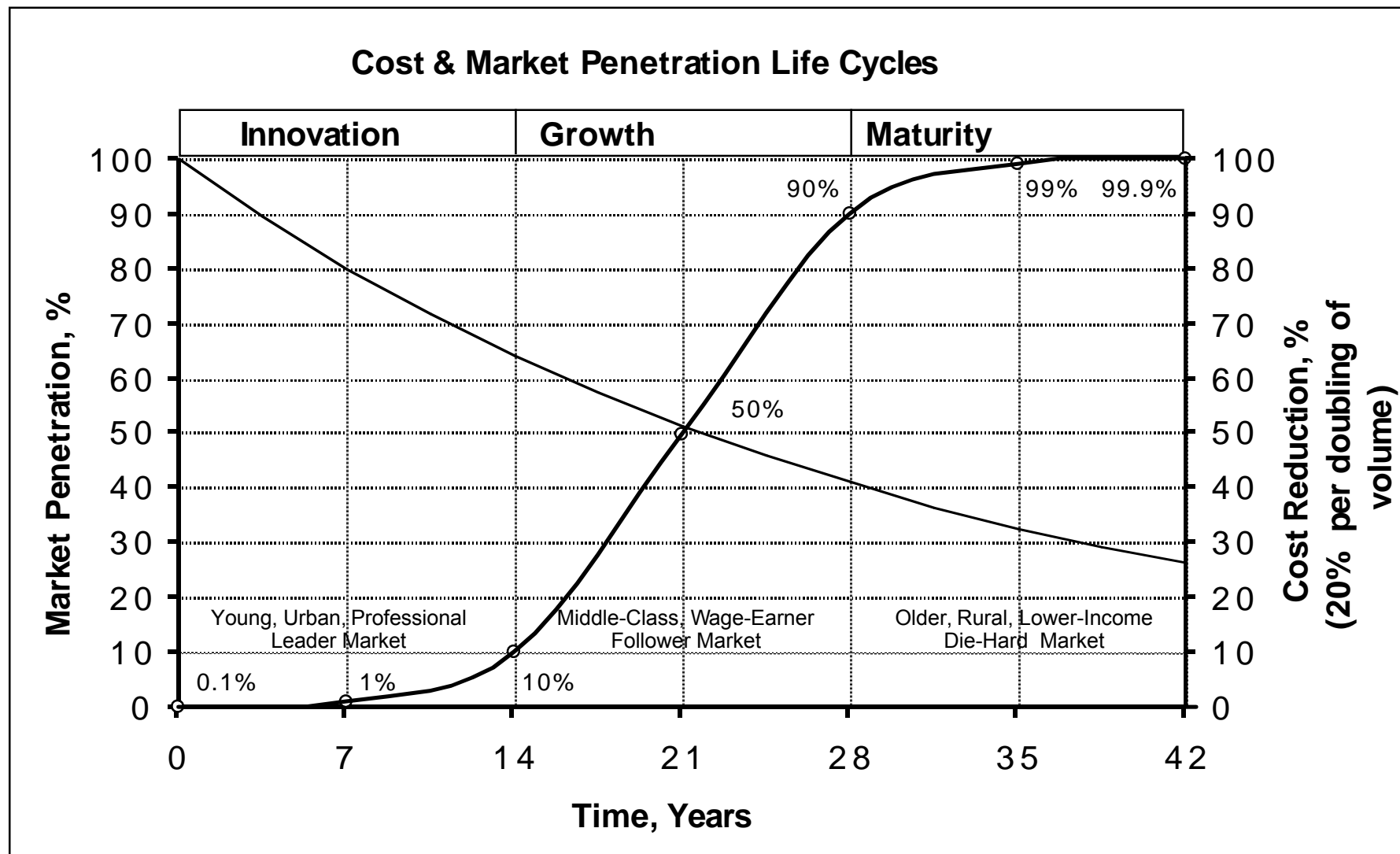


Innovation and Cost Life Cycles

(Trends follow classic “S-Curve” for innovations, Hugh B. Stewart, *Recollecting the Future*, 1988)



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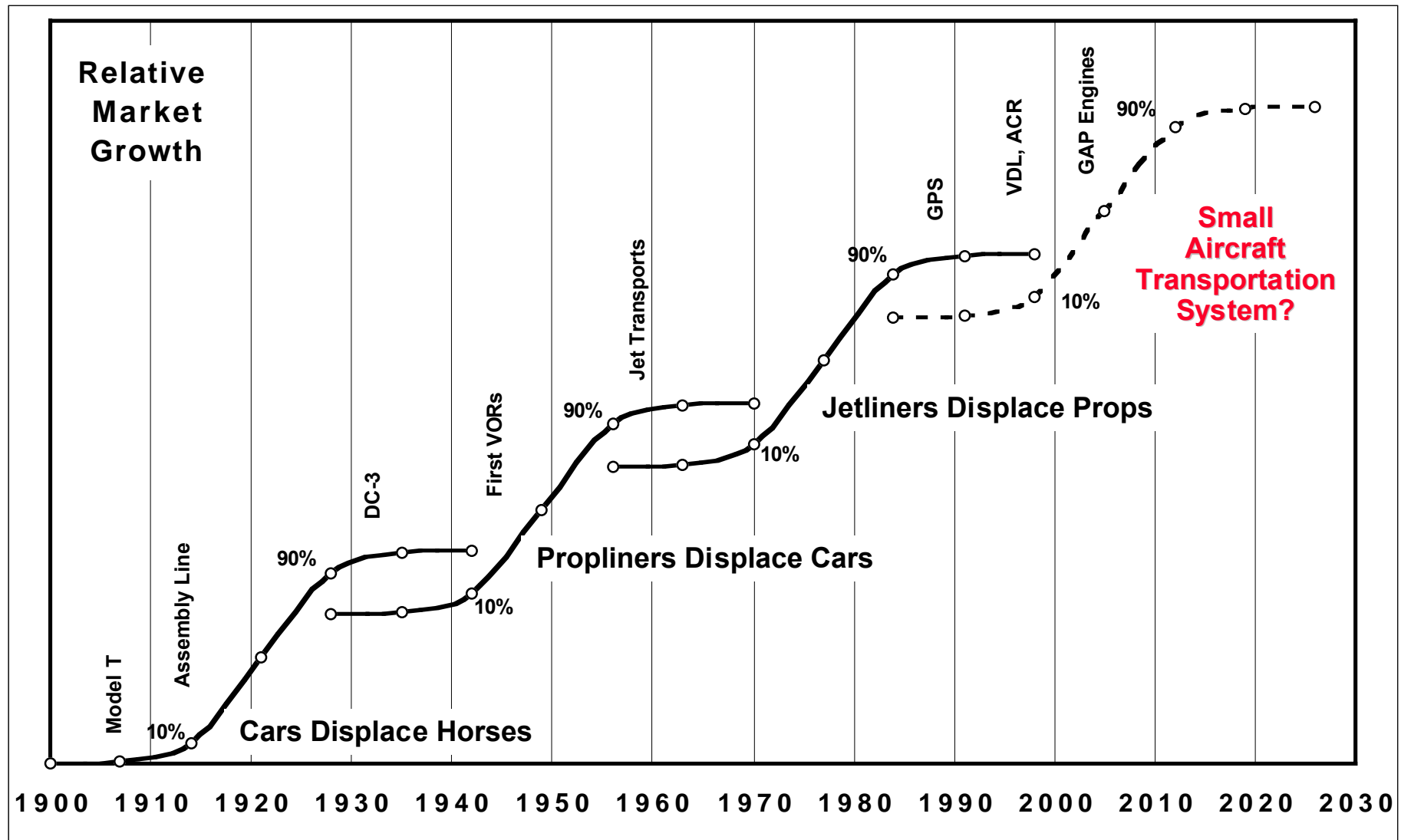
(R)evolutions in Higher Speed Travel

What is Next? More Speed to More Destinations



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The “Atomic Structure” of Business Innovation Cycles



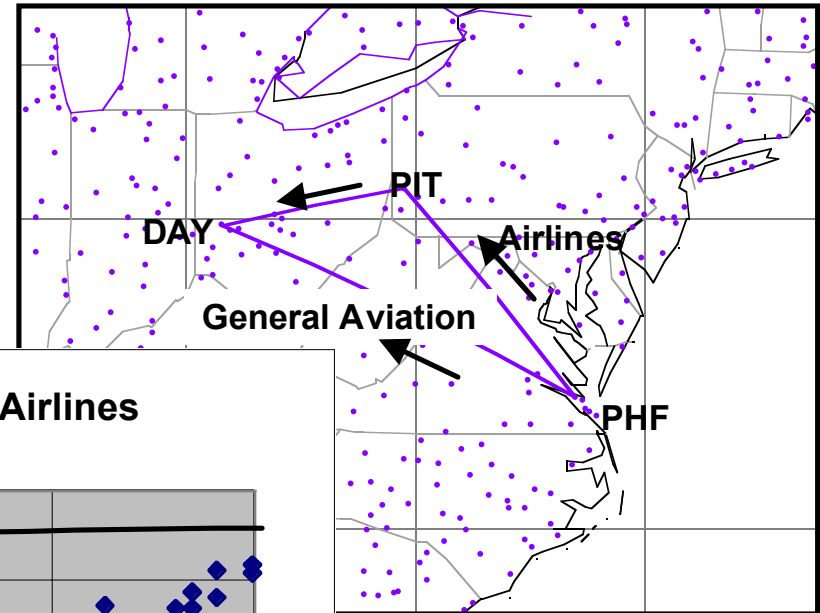
Small Aircraft Transportation System Mobility

"...doorstep-to-destination at four times the speed of highways..."

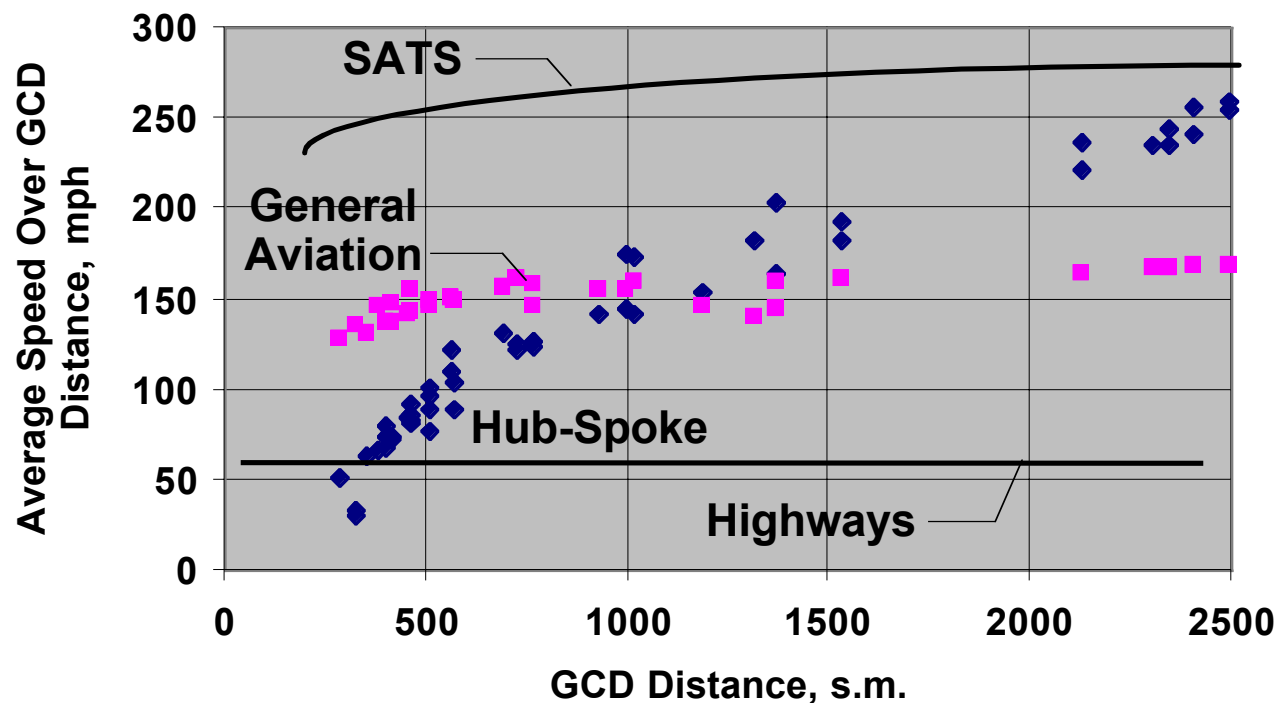


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SATS reduces travel times,
while highways and Hub-and-spoke travel times
will continue to increase.



Comparison of Average Speeds for GA and Airlines



- Hub-Spoke: OAG times for 28 destinations
- General Aviation: time-optimized flight plans
- Including intermodal penalties (:45 +:45 for airline & :30+:30 for GA departure & arrivals)
- No GA destination benefit (for proximity of airports)
- SATS with new GAP engines: costs equal current General Aviation at 2 times the speed.

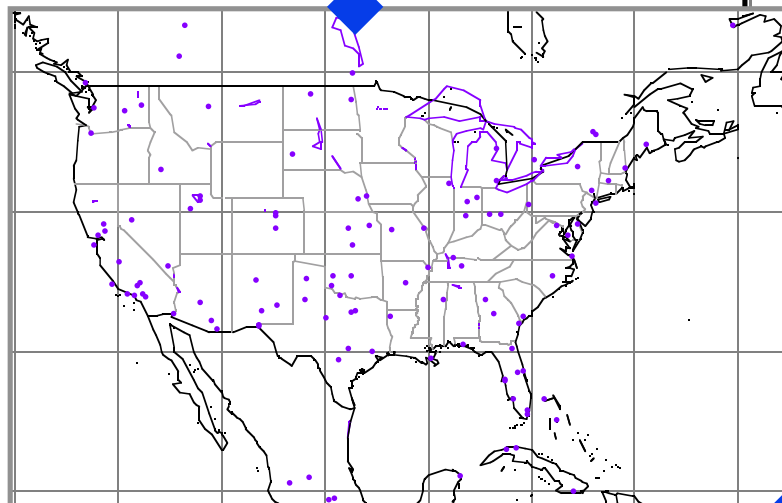
Small Aircraft Transportation System Accessibility

(“...to suburban, rural, and remote communities. . .”)

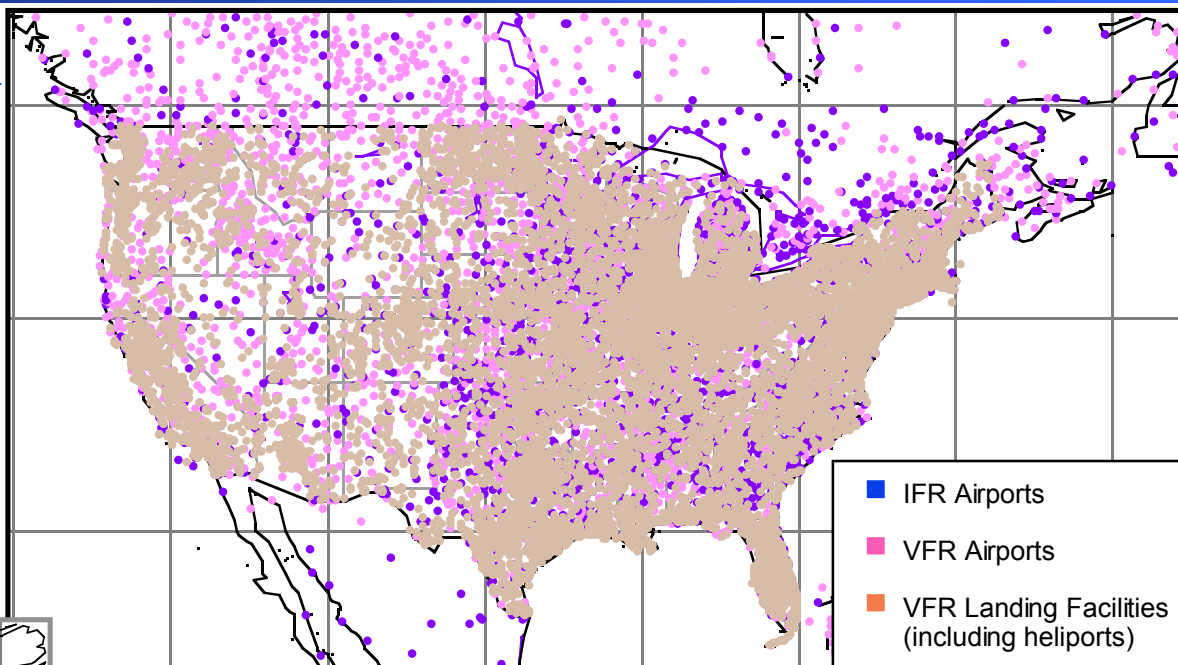


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**Expanded SATS Accessibility to
several times more destinations**



Of 5,400 public-use airports, only 715 (13%)
have precision instrument approaches (ILS)

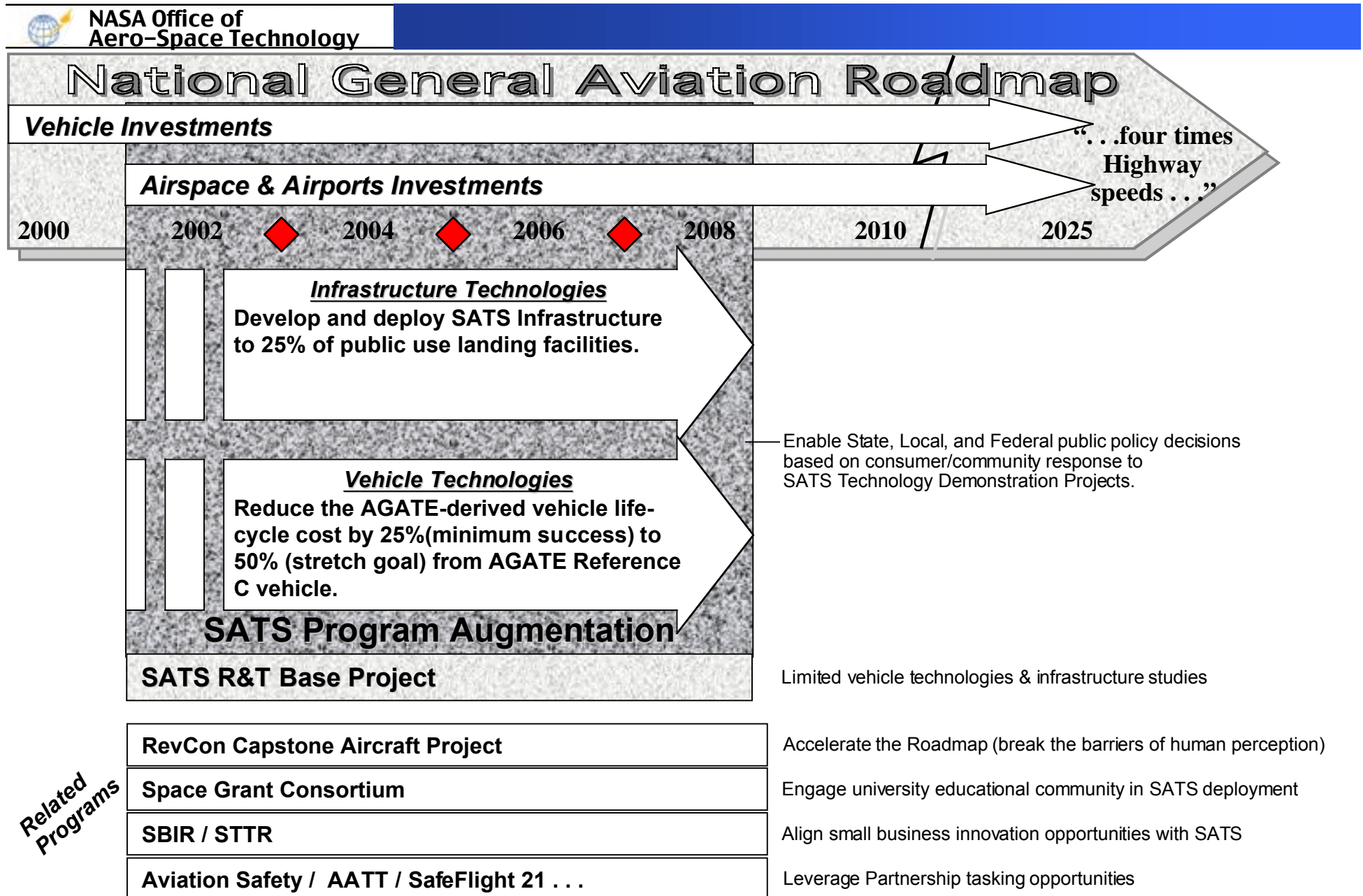


- IFR Airports
- VFR Airports
- VFR Landing Facilities (including heliports)

**Fully utilized 5,400 public-use near-
all-weather landing facilities can
increase theoretical NAS Throughput
by more than an order of magnitude**

**Expanded SATS Throughput for
several times more travelers**

Program Description



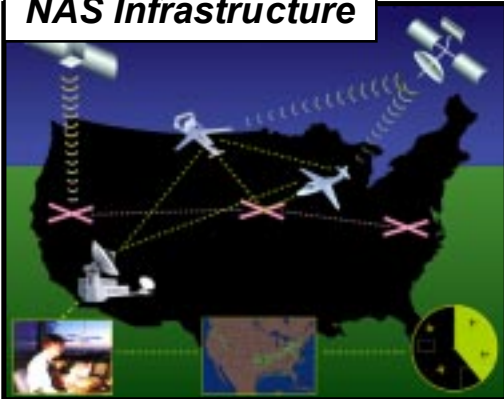
Technical Approach/Objectives

(With Augmentation)



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NAS Infrastructure



- “Smart” Airports (Mini-LAAS, Datalink FIS, TIS, Airport Databus/CIS Standards)
- ADS-B-based EnRoute & Terminal Free Flight at non-towered, non-radar airports
- “Virtual” TerPs
- Satellite-based Comm-Nav-Surveillance

Single-Crew Flight Deck Systems & Operations



- Decoupled controls
- Envelop protection
- Ride quality
- Affordable software certification
- Virtual Highways in the Sky/Electronic VFR
- Satcomm data radios

Pilot Training

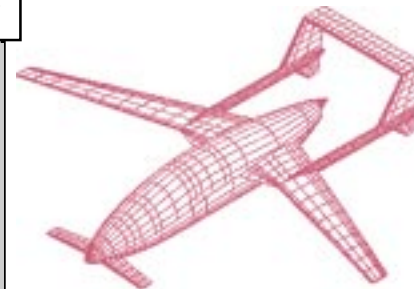


- Onboard Cyber-Tutor
- InterNet Training
- 50% savings in time and cost

**Close the 21st Century
Transportation Demand-Supply
Gap**

Airframe Systems

- <\$30 per lb. composites, assembled
- Optimized ice, lightning, & crash protection
- Aerodynamics for performance and cost



Propulsion Systems

- <<\$50,000 Turbine
- <\$15,000 Compr.-Ignition
- Quieter propulsion
- Non-hydrocarbon options

A New Beginning

(Resulting from Current Aeronautics Investments: AGATE, GAP)



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- Cirrus and Lancair are the first new Single-Engine, Type Certificated Airplanes in over 15 years. Technologies derived from past 20 years of NASA Aeronautics research .
- Key indicators signal the long-term potential for payoffs from NASA technology strategy:
 - Warren Buffett's (Berkshire-Hathaway) purchase of Executive Jet Aviation and Flight Safety International
 - Toyota Motors USA development of lightplane products for U.S. and world markets (with indications of Honda intentions to follow)

Major Challenges

What is Required to Reach Three Pillars GA Goal?



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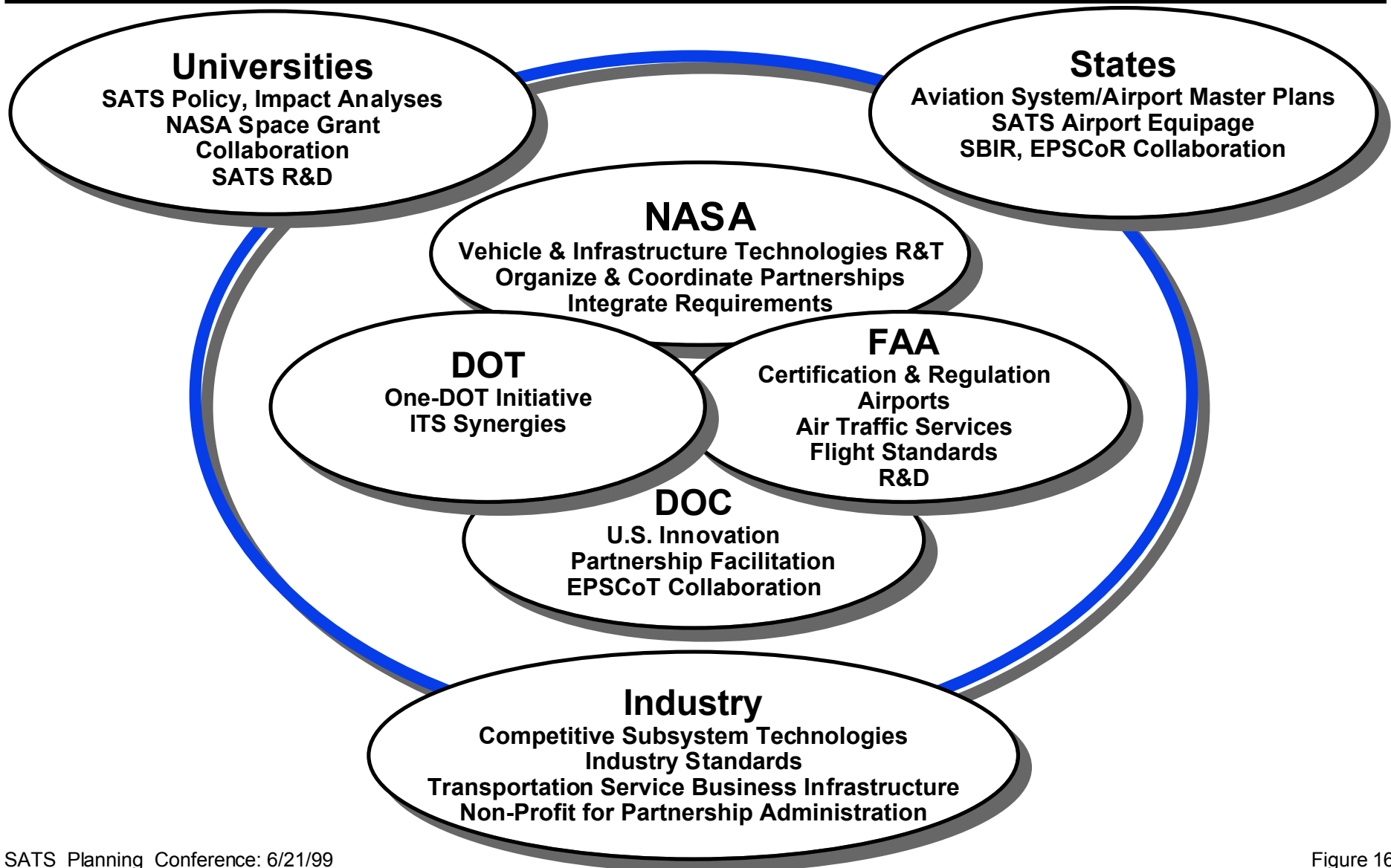
Technologies Targeted on Public Good Metrics							
	<i>"Public Good" Impact Metrics</i>						
<i>Technologies</i>	<i>Mobility (Accessibility)</i>	<i>Safety</i>	<i>Capacity (Throughput)</i>	<i>Noise</i>	<i>Emissions</i>	<i>Land Use</i>	<i>Energy Use</i>
NAS Infrastructure Integration: • C N S • A T M • Airspace • Airports	X	X	X	X	X	X	X
Propulsion Systems	X	X	X	X	X		X
Single-Crew Flight Deck Systems & Operations	X	X	X	X		X	X
Airframe Design & Manufacturing	X	X		X	X		

Candidate Federal-States SATS Partnership Roles



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"Enable doorstep-to-destination travel at four times the speed of highways . . ."



Current States Roles in SATS Planning



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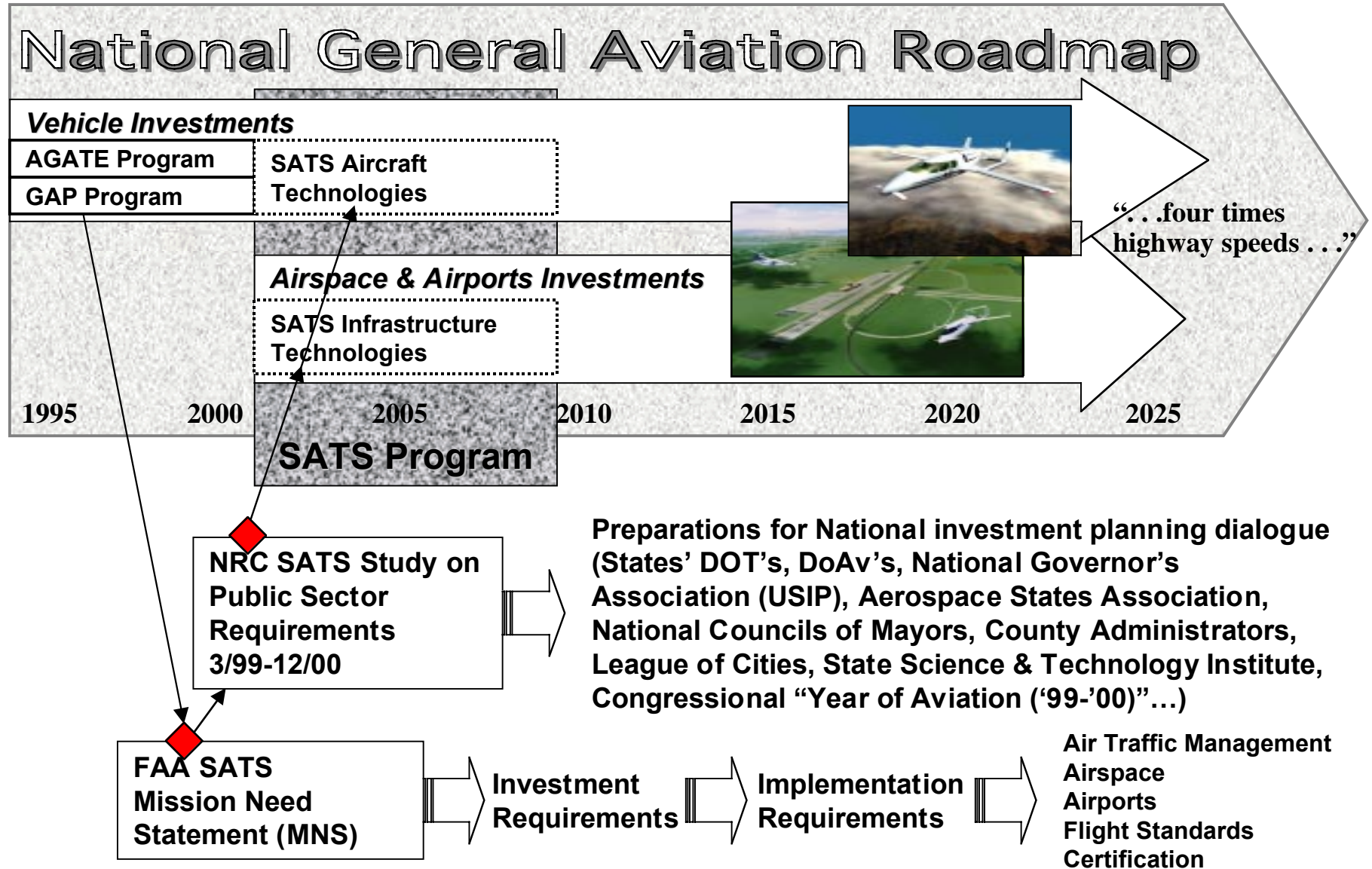
- **SATS “Leader” States Committed to Planning Support**
 1. Virginia
 2. Florida
 3. Nebraska
 4. North Dakota
 5. Oklahoma
 6. Kansas
 7. Illinois
 8. Indiana
 9. Wisconsin
 10. Washington
- **Intra-State SATS Steering Groups**
- **EPSCoR funding leveraged (e.g., Nebraska, Kansas)**
- **NASA Space Grant Consortium potential leveraging**
- **SBIR / STTR leveraging**
- **Aerospace States Association SATS Resolution (43 states)**



Summary of Actions Proposed with States

- **Establish Federal-States partnership mechanisms for SATS Infrastructure Technology development (through OSTP/DOC/NGA U.S.I.P.).**
- **Engage “Leader” States in process to incorporate Roadmap Goal metrics into State Aviation System Plans (“...doorstep-to-destination travel at four times the speed of highways...”).**
- **Engage States in Small Business Innovation Research (SBIR), EPSCoR, and Space Grant Consortium SATS Topic implementation.**
- **States select communities for SATS consumer analysis for measurement of traffic, economic effects, technology priorities.**
- **Implement SATS Demonstrations at selected communities to measure SATS consumer response and community response.**
- **Summarize results for use in State, Local, and Federal decisions to deploy SATS infrastructure throughout states & regions.**

Roadmap Planning and Coordination

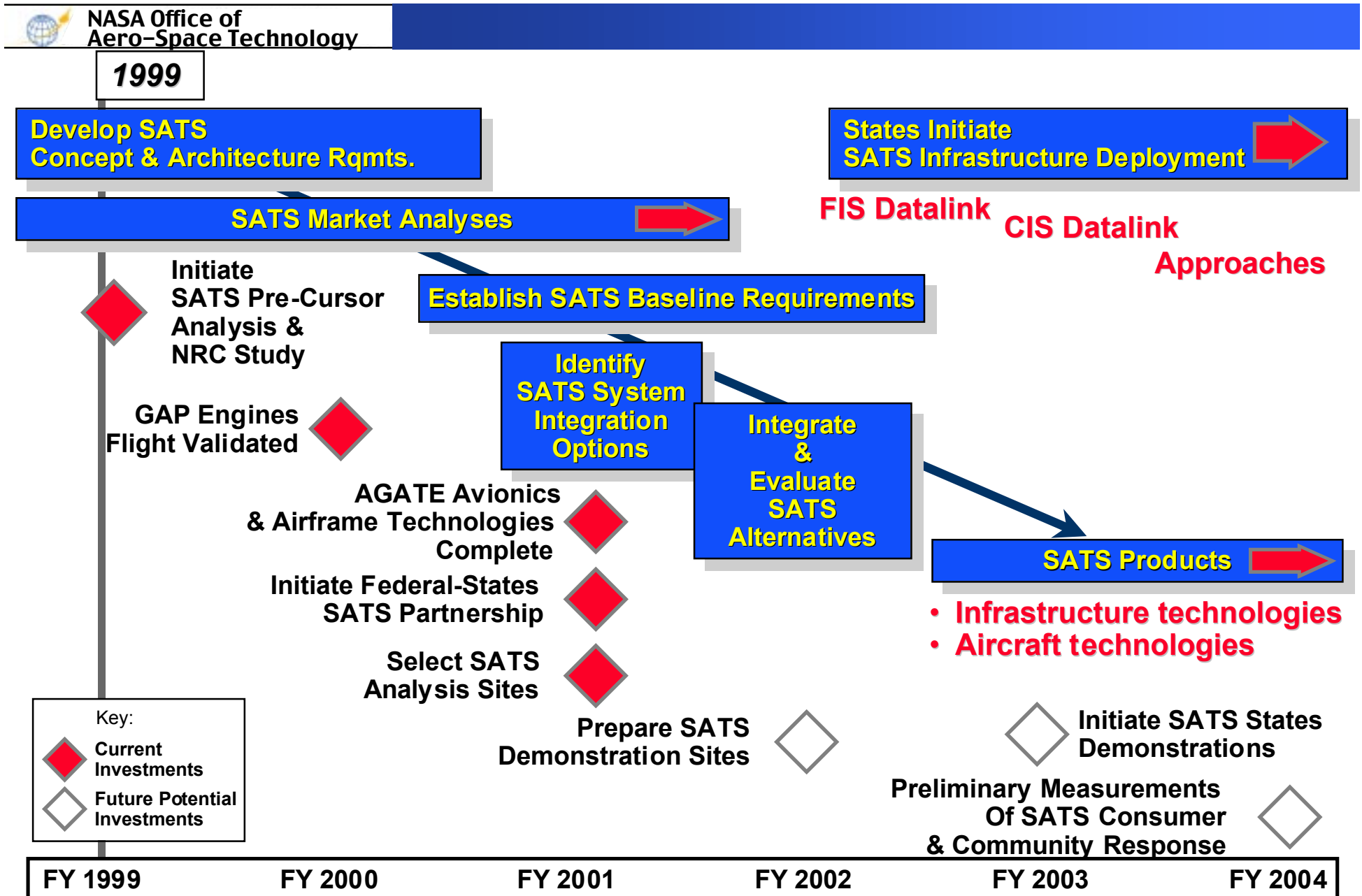


SATS Planning Assumptions



- **Alliance-based program**
- **Cost-sharing (50/50 model)**
- **Collaboration for pre-competitive technologies**
- **Competition for competitive technologies**
- **FY 2001 to FY 2008 program with major demonstrations on 2-year centers**
- **FAA SATS Mission Need Statement influences NAS Architecture (5.x)**
- **U.S. industry and States will meet the challenge**

GA Roadmap Milestones FY 2000 - 2004



Small Aircraft Transportation System (SATS) End-State



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***SATS closes the demand-supply gap for
high speed, intermodal personal and business
mobility and accessibility for a more diverse population of travelers.***



***NASA/FAA/DOT Challenge: Integrated national aeronautics
technology strategy to include highly affordable, safe,
convenient, neighborly vehicles and expanded infrastructure***